Biomimetic Characteristics of an Active Deployable Structure

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Can active control strategies that include learning and self-repair be applied to civil structures?

Key Concepts

Biomimetics:
The field that studies systems having properties that were inspired by the behavior of biological organisms

Active Structure:
Engineering structure containing elements such as sensors and actuators that, when active, modify the response of the structure to its environment

Deployable Structure:
Structure capable of large configuration changes from a packaged, compact state to a deployed state

Tensegrity:
System in a stable self-equilibrated state comprising a set of compressed components inside a continuum of tensioned components

Objectives

Design an active control system to ensure the damage tolerance of a deployable tensegrity pedestrian bridge

Extend existing strategies for **self-diagnosis** to the deployable tensegrity bridge

Extend existing strategies in order to achieve a robust **self-repair** scheme

Design and develop algorithms that allow the active control system to **learn**

Verify the control system components with experiments on a near full-scale (1/3) model

Major Challenges

Determination of most critical cables

Optimization of the active control system

Improvement of the existing self-diagnosis method

Integration of system identification into self-diagnosis procedure

Enhancement and adaptation of self-repair methods

Improvement of control through multi-objective search

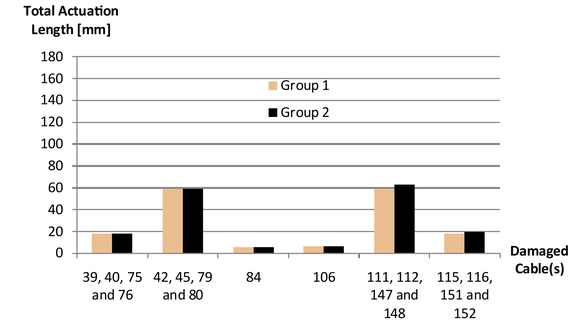
Control command selection strategy

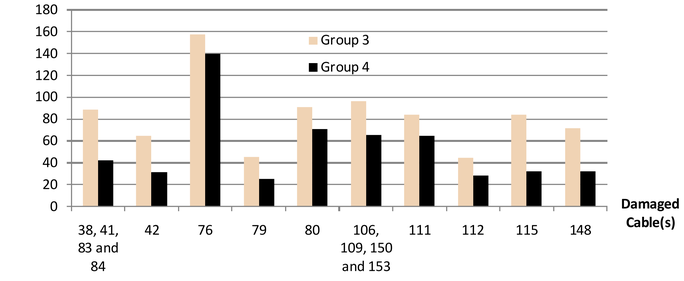
Enhancement of the efficiency of the current learning method

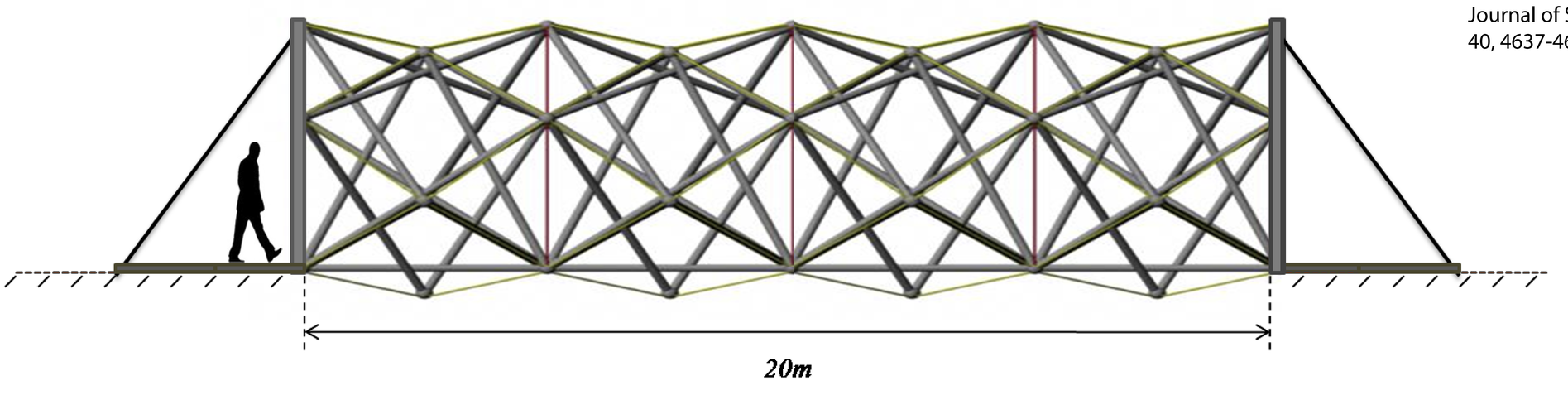
Assessment of the efficiency of the system to be proposed

Example of Results

Cable members of the tensegrity bridge are gathered into four groups. Results indicate that one of the groups outperform the other three groups in terms of active control effectiveness.







Sample References

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